Sample assessment task	
Year level	6
Learning area	Technologies
Subject	Design and Technologies: Engineering principles and systems
Title of tasks	Power, input, control and output, and watch that wire
Task details	
Description of tasks	1. Students will investigate stored power supplies, types of batteries and materials in batteries and the different types of switches as control devices. Students will investigate output devices and how they work, different sound-making and light-making devices and the components of small DC motors. 2. Students will design and make a steady hand tester for a junior primary class.
Type of assessment	Formative
Purpose of assessment	To assess students' understanding of electrical energy inputs/outputs and collaboration with peers
Assessment strategy	Written work and work samples
Evidence to be collected	• Work booklet • Designing sheet/s • Final product
Suggested time	10 x 1 hour sessions
Content description	
Content from the Western Australian Curriculum	***Knowledge and understanding*** **Engineering principles and systems** Electrical energy and forces can control movement, sound or light in a product or system ***Processes and production skills*** **Investigating and defining** Define a problem, and set of sequenced steps, with users making decisions to create a solution for a given task **Investigating and defining** Identify available resources **Designing** Design, modify, follow and represent both diagrammatically, and in written text, alternative solutions using a range of techniques, appropriate technical terms and technology **Producing and implementing** Select, and apply, safe procedures when using a variety of components and equipment to make solutions **Collaborating and managing** Work independently, or collaboratively when required, considering resources and safety, to plan, develop and communicate ideas and information for solutions **Evaluating** Develop collaborative criteria to evaluate and justify design processes and solutions

Task preparation	
Prior learning	Students have an understanding that forces can control movement, sound or light in a product or system.
Assessment differentiation	Teachers should differentiate their teaching and assessment to meet the specific learning needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment tasks.
Assessment task	
Assessment conditions	In groups
Resources	• Resource booklet with web resources attached • Electrics kit (batteries, switches etc.) • Materials to make the hand tester, as determined by the students through their research

Instructions for teacher

Points of teaching and student understanding

Batteries

1. An understanding of batteries, starting with a definition
2. The components of a typical battery
3. How a battery releases the stored energy
4. Types of batteries

Likely source of information https://en.wikipedia.org/wiki/Battery_(electricity)

Switches

1. An understanding of switches within a circuit
2. The actions that activate switches
3. Types of switches
4. The components of a typical household light or power switch
5. Different switches for different uses

Likely source of information https://en.wikipedia.org/wiki/Electrical_switch#

Wires

1. Conductive, stiff wire
2. Flexible insulated wire
3. Methods of joining and connections

Output Devices

Sound

1. An understanding of how sound is generated through buzzers, speakers and electro-mechanical methods
2. The components of a typical sound-making device
3. Different devices for different uses

Light

1. An understanding of how electric light is generated through an incandescent light bulb
2. The components of a typical electric light
3. Different materials for different types of lighting devices

Movement in motors

1. An understanding of how rotational movement is generated through electro-mechanics
2. The components of a typical, small, DC electric motor
3. Different voltages for different motors

Likely sources of information https://en.wikipedia.org/wiki/Buzzers
https://en.wikipedia.org/wiki/Incandescent_light_bulb
https://en.wikipedia.org/wiki/Electric_motor

Student activities

With an understanding of power supplies, switches, lights, buzzers and motors, students can investigate and design a steady hand tester.

Instructions to students

Lesson 1: 180 minutes approximately

1. Instruct students in the investigation of batteries and allow them to understand the general definition of a battery.
   A collection of different types and makes of battery will be necessary for these activities.
   Students will;
   a) list or draw out the components of a typical battery
   b) explain how a battery releases the stored energy
   c) recognise the different types of available batteries and their voltages.

2. Instruct students in the investigation of switches.
   A collection of different types of switches will be necessary for these activities.
   Students will:
   a) develop an understanding of switches within a circuit
   b) explain the different ways switches are activated
   c) list the different types of switches
   d) look at the different components of a typical household light or power switch
   e) identify different switches for different uses.

3. Instruct students in the investigation of output devices.
   A collection of different types of output devices for sound, light and motion will be necessary for these activities.
   Students will investigate these output groups, and:
   Sound
   a) develop an understanding of how sound is generated through buzzers (piezo), speakers (audio) and electro-mechanical methods (alarm bells or sirens)
   b) identify the typical sound-making devices and the materials that make the devices
   c) identify different devices for different uses
   Light
   d) develop an understanding of how electric light is generated through investigation of an incandescent light bulb
   e) identify the components and materials used within a typical electric light
   f) identify the different materials for different types of lighting devices
   Movement in motors
   g) understand how rotational movement is generated through electro-mechanics
   h) list, or draw and label the components of a typical, small, DC electric motor
   i) realise the influences of different voltages on a small DC motor.

Lesson 2: 120 minutes approximately

Explain to students that we will be designing and making a steady hand tester for use in junior primary to help develop hand and eye coordination skills. The finished product should look visually pleasing to junior primary students. The hand tester must light up a globe and sound a buzzer to show that the wire has been touched.

If they are unclear about what a steady hand tester is, show the students the following video clip:
http://www.youtube.com/watch?v=4g7TBXnLucA

In the task book, ask students to describe the problem. Give the problem a title other than simply steady hand tester.

In pairs, ask students to visit the website http://www.bbc.co.uk/bitesize/ks2/science/physical_processes/electrical_circuits/read/1/ to learn about simple electric circuits.

Students are to draw an annotated diagram of a simple circuit with a switch to light a bulb in their task book.

Students to independently investigate the design of steady hand testers and the materials needed to make one. Students are also to investigate the importance of hand to eye coordination in young children.

Students are to draw and label a diagram of the parts of a simple hand tester in the task book.

Ask students to draw possible shapes for their steady hand tester. Ask them to consider each of the designs they have sketched and decide on one to make. They must explain why they have chosen that particular design.

Students will need to brainstorm possible circuit plans they will follow to make the buzzer and light work when touched by the wire.

Students now need to draw two designs, including annotations of their steady hand tester:

1. the structural design for assembly of wiring and components
2. the decorative design that will appeal to junior primary students.

Students should now consider the materials they will need, and then list these materials to make their steady hand tester.

Allow time for students to investigate different joining/fastening techniques they could use when making their steady hand tester and explain these in their task book.

Students will need to independently develop 3 - 5 criteria to evaluate their steady hand tester.

Lesson 3: 240 minutes approximately, plus evaluation time of 60 minutes approximately

Stress the need for cooperation in sharing materials and equipment to complete the task and adhering to safety precautions.

Teacher is to observe safe use of equipment and tools.

Allow time for students to construct and decorate their steady hand tester.

Take a photo of each completed hand tester for inclusion in task book.

Part One:

Power Batteries, Switches and Output devices **Name: _____**

Batteries

1. List or draw and label the components of a typical battery.

2. Explain how a battery releases the stored energy.

3. Find and list at least eight different types of available batteries and their voltages.

Battery type (Code)	Voltage (V)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Switches

Observing where switches are within an electrical circuit

1. Draw and label a simple diagram to describe how a switch controls the electricity within a circuit.

2. Find an image for each of the following switches.
3. What different ways are switches activated?
4. Identify different uses for each switch.

Switch type	Sample image	Method of switch activation	Where is this switch used?
Rocker switch			
Toggle switch			
Push-button switch			
Micro-switch			
Reed switch			
Mercury switch			
Slide switch			
Rotary switch			
DIP switch			

Observing how switches are assembled

5. List the different components of a typical household light or power switch. You should find **at least six.**

Output devices

Sound

1. Find and write out a simple explanation of how sound is generated through each different output device.
2. Identify the materials within each sound-making device.
3. Identify different uses for each device.

Sound output device	Method of sound generation	Materials within device	Uses for device
Piezoelectric buzzers			
Electromagnetic buzzers			
Audio speakers			
Alarm bells			
Sirens			

Light

1. Find an explanation for how electric light is generated in an incandescent light bulb.

2. Identify the components and materials with a Light Emitting Diode (LED).	

3. Identify the different materials for different types of lighting devices.

Different lighting devices	**Materials within device**
Low-voltage DC filament bulb	
AC house hold filament bulb	
Halogen bulb	
LED globe	
Fluorescent tube lighting	

Movement in motors

1. Find an explanation for how rotational movement is generated through electro-mechanics.

2. List the components and draw a diagram of the inside of a typical, small, DC electric motor.

3. Using a small DC motor and different batteries, find out what influence will an increase or decrease in voltage have on a small DC motor.

Part Two:

Watch that wire!

Name: _____

Define the problem (Design brief) and give it an interesting design title.

Title _____

_____

_____

_____

_____

Investigating and defining

Draw a simple circuit using symbols for a battery, switch, wire and light bulb. Annotate your diagram.

Investigating and defining

Investigate and report on the different types of steady hand testers.

List the common features found in steady hand testers.

Example One

_____

_____

_____

_____

Example Two

_____

_____

_____

_____

Example Three

_____

_____

_____

_____

Investigating and defining

Investigate the importance of hand to eye coordination in young children.

Designing

In the space provided, sketch possible designs for your steady hand tester. Remember the steady hand tester must appeal to junior primary students.

Consider each of the shapes you have sketched and decide on one to make. Explain why you have chosen that particular shape.

Designing

Sketch possible electrical circuits you will follow to make the globe and buzzer work when the wire touches it. Include annotations, where needed.

Designing

Draw the design for your steady hand tester, including annotations. Make sure you have labelled each part of the steady hand tester, using correct technical terms.

Designing

Design and draw a decorative background in colour for your steady hand tester that reflects the design title you have chosen.

Producing and implementing

Detail the materials you will need for your steady hand tester.

Will you need to bring any materials from home?

Producing and implementing

You will be required to join different materials together. Refer back to your design. Draw and label here the types of fastenings/joins you might use. You may research this, if needed. These could take the form of simple diagrams, images and/or pictorial and/or schematic drawings.

Evaluating

Develop a criteria sheet to evaluate your steady hand tester. There must be a minimum of three and a maximum of five. Look back at your design brief to things to ask about the finished steady hand tester.

Evaluate your steady hand tester by commenting on your selected design criteria.

Evaluating

Include a photo of your finished steady hand tester.

What safety rules and collaborative processes did you apply when working with other students, the tools and equipment? Why is it important that we collaborate with others and follow these safety rules?

Sample marking key

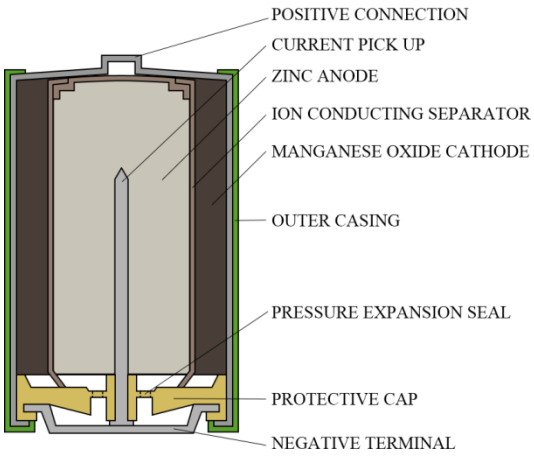
Batteries

Description	Marks
List and label a drawing of the component of a typical battery	
Correctly labelled drawing.	5–6
Labelled, but minor errors in drawing or labelling.	3–4
Incomplete drawing and/or labelling.	1–2
Subtotal	**6**

Answer could include, but is not limited to:

Correctly identified and labelled components for an alkaline battery

- Positive connection (terminal)
- Negative terminal
- Outer casing
- Cathode
- Anode
- Ion conducting separator



Section through and labelled Alkaline battery

https://commons.wikimedia.org/wiki/File:Alkaline-battery-english.svg#/media/File:Alkaline-battery-english.svg

Description	Marks
Explain how the battery release the stored energy	
Comprehensively describes how the battery releases the stored energy.	5–6
Briefly describes how the battery releases the stored energy.	3–4
Provides a limited description of how the battery releases the stored energy.	1–2
Subtotal	**6**

Answer could include, but is not limited to:

An electric battery is a device consisting of two or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell has a positive terminal, or cathode, and a negative terminal, or anode. The terminal marked positive is at a higher electrical potential energy than is the terminal marked negative. The terminal marked positive is the source of electrons that, when connected to an external circuit, will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work.

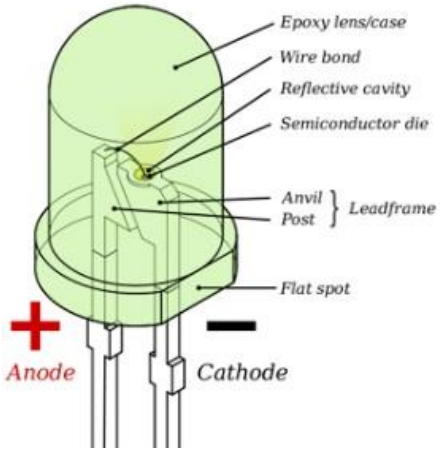
https://en.wikipedia.org/wiki/Battery_(electricity)

Description	Marks
Find and list at least eight different types of available batteries and their voltages	
Lists correctly batteries and their voltages. (one mark for each different type of battery and correct voltage)	1–8
Subtotal	**8**
Answers could include, but is not limited to: • 9 V or 4.5 V lantern • D cell (R20) torch battery • C cell (R14) torch battery • AA (R6) torch battery • AAA (R03) pencil battery • AAAA (R61) battery • A23 (8LR932) battery • 9-Volt (6LR61) "square" battery • CR2032 lithium coin battery • LR44 coin battery	
Batteries Total	**20**
Switches	
Description	
Drawn and labelled diagram to describe how a switch controls the electricity within a circuit	
Comprehensively labelled and drawn diagram to describe how a switch controls the electricity within a circuit.	✓✓✓✓
Adequately labelled and drawn diagram to describe how a switch controls the electricity within a circuit.	✓✓
Limited labelling and incomplete drawing to describe switch controls.	✓
Description	
Images of the different switches, the method of activation and switch uses	
Correctly placed images of switches, with each method of activation identified and the common uses of each switch explained.	**Completed**
	Not completed
Description	
List of the different components (six) of a typical household light or power switch	
Correctly names at least six components of a domestic power/light switch.	**Completed**
	Not completed
Switches	
Output devices – Sound	
Description	
Explain the method of sound generation, materials within the device and devices uses	
Correct explanation of sound generation, identification of materials within the device and the common uses of each device.	**Completed**
	Not completed

Output devices – Light	
Description	
Explain how electric light is generated in an incandescent light bulb	
Comprehensively describes how electric light is generated.	✓✓✓✓
Briefly describes how electric light is generated.	✓✓
Provides a limited description of how electric light is generated.	✓
Description	**Marks**
Identify the components and materials with a Light Emitting Diode (LED)	
Correctly names at least six components of a domestic power/light switch. (**one mark** for each different piece of information collected and presented)	1–6
Subtotal	**6**

Answer should include, but is not limited to:

https://en.wikipedia.org/wiki/File:LED,_5mm,_green_(en).svg



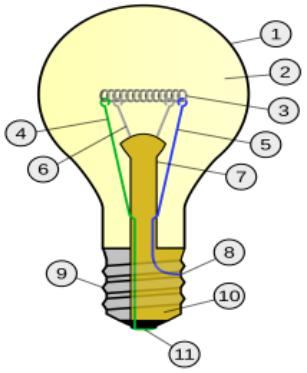
Description	**Marks**
Identify the different materials for the five different types of lighting devices	
Comprehensively identifies the different materials for all five different types of lighting devices.	9–10
Correctly identifies the different materials for at least four different types of lighting devices.	7–8
Correctly identifies the different materials for at least three different types of lighting devices.	5–6
Correctly identifies the different materials for two different types of lighting devices.	3–4
Limited identification of the different materials.	1–2
Total	**10**

Answer could include, but is not limited to:

Answer should include, but is not limited to:

Parts of a typical filament bulb

1. Outline of glass bulb
2. Low pressure inert gas (argon, nitrogen, krypton, xenon)
3. Tungsten filament
4. Contact wire (goes out of stem)
5. Contact wire (goes into stem)
6. Support wires (one end embedded in stem; conduct no current)
7. Stem (glass mount)
8. Contact wire (goes out of stem)
9. Cap (sleeve)
10. Insulation
11. Electrical contact



https://commons.wikimedia.org/wiki/File:Incandescent_light_bulb.svg

Output devices sound/light	
Movement in Motors	
Description	
Explain how rational movement is generated through electro-mechanics	
Comprehensively describes how rotational movement is generated.	✓✓✓✓
Briefly describes how rotational movement is generated.	✓✓
Provides a limited description of how rotational movement is generated.	✓
Description	**Marks**
Listed components and drawn diagram to describe the inside of a typical small DC electric motor	
Comprehensively listed components and drawn diagram to describe the inside of a typical, small, DC electric motor.	✓✓✓✓
Adequately listed components and drawn diagram to describe the inside of a typical, small, DC electric motor.	✓✓
Limited list of components and/or poorly drawn diagram to describe the inside of a typical, small, DC electric motor.	✓
Description	**Marks**
Identify what influence an increase or decrease in voltage will have on a small DC motor	
Comprehensively records the influences of an increase or decrease in voltage on a small DC motor.	✓✓✓✓
Adequately records the influences of an increase or decrease in voltage on a small DC motor.	✓✓
Limited record provided on the influences of an increase or decrease in voltage on a small DC motor.	✓
Movement in motors	
Theory worksheet total	**36**

Sample marking key

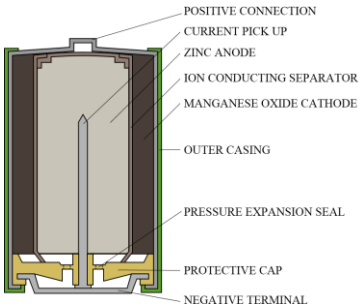
Marking keys for Watch that Wire!

Description	Marks
Investigating and defining	
Provides design title and description of the problem	
Interesting and original design title with clear statements defining the problem.	3
Includes general statements to define the problem.	2
Defines the design problem in limited general terms only.	1
Subtotal	**3**
Provides a simple circuit diagram, with annotated symbols	
Correct development of the circuit, clearly annotated components using the correct symbols.	3
Correct arrangement of symbols on the circuit, using clear annotations.	2
Drawn arrangement of symbols, with little or some simple annotation.	1
Subtotal	**3**
Provides information about three different steady hand testers	
Detailed information about a number of existing similar products, with source referencing, using the design considerations to make detailed comparisons.	3
Comparisons between a number of images with notes describing the general differences.	2
Collection of dissimilar images, or ideas about a single product, with limited annotation about likes and dislikes.	1
Subtotal	**3**
Provides ideas about the importance of hand to eye coordination in young children	
Comprehensively describes the importance of hand to eye coordination in young children.	3
Briefly describes the importance of hand to eye coordination in young children	2
Provides a limited description of the importance of hand to eye coordination in young children.	1
Subtotal	**3**
Investigating and defining total	**12**

Description	Marks
Producing and implementing: provides list of materials, parts and components required	
Lists are complete, logical and clearly presented; items are clearly identified, may include home items.	3
List is mostly complete; items are identified, with additional home items included.	2
Lists are missing a significant number of items and/or there is a lack of logic as to how these are collated; items are rarely identified or described.	1
Subtotal	**3**
Description	**Marks**
Provides working drawings fastenings/joins. These could take the form of simple diagrams, collected images and/or pictorial and/or schematic drawings.	
Drawings are neat, accurate and clearly annotated, with all required critical information.	3
Drawings are neat, accurate and clearly annotated, with most of the required critical information.	2
Drawings are lacking accuracy and/or annotations that provide critical information.	1
Subtotal	**3**
Producing and implementing total	**6**
Description	**Marks**
Evaluating and collaborating and managing: evaluation comments with regards to the specifications and design considerations of at least three selected criteria	
Clear comments referring to specific design criteria, combined with justification of solution, fulfilling design requirements.	4
Comments outlining major function of solution, and referring to points within design requirements.	3
Comments linked to design criteria, but expressing simple personal likes and dislikes about finished project.	2
Comments reflect superficial evaluation.	1
Subtotal	**4**
Description	**Marks**
Evaluating and collaborating and managing: comments on the safety rules and collaborative processes	
Clear comments referring to specific safety rules and considerations; full explanations of collaborating with others.	3
Appropriate comments on safety rules and collaborative processes.	2
Comments reflect superficial consideration for safety rules; brief comments with few references to collaboration.	1
Subtotal	**3**
Evaluating, plus collaborating and managing total	**7**
Watch that wire task total	**25**

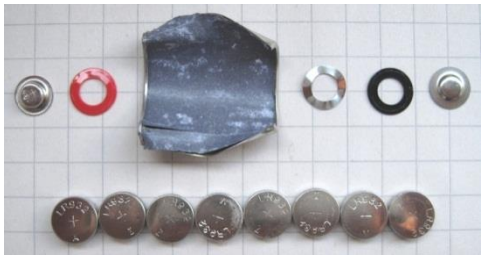
Support References *resources booklet*

Examples of Batteries



Section through and labelled Alkaline battery
https://commons.wikimedia.org/wiki/File:Alkaline-battery-english.svg

A partially opened 4LR44 battery showing the arrangement of the 4 1.5V LR44 cells; with an intact example for comparison
https://commons.wikimedia.org/wiki/File:4LR44-battery-open-closed.jpg


A fully opened and laid out A23 battery showing terminals, insulating washers, case and 8 1.5V LR932 alkaline button cells
https://commons.wikimedia.org/wiki/File:A23-8LR932-open.jpg

A PP7 9V battery manufactured by Eveready
https://commons.wikimedia.org/wiki/File:PP7.jpg

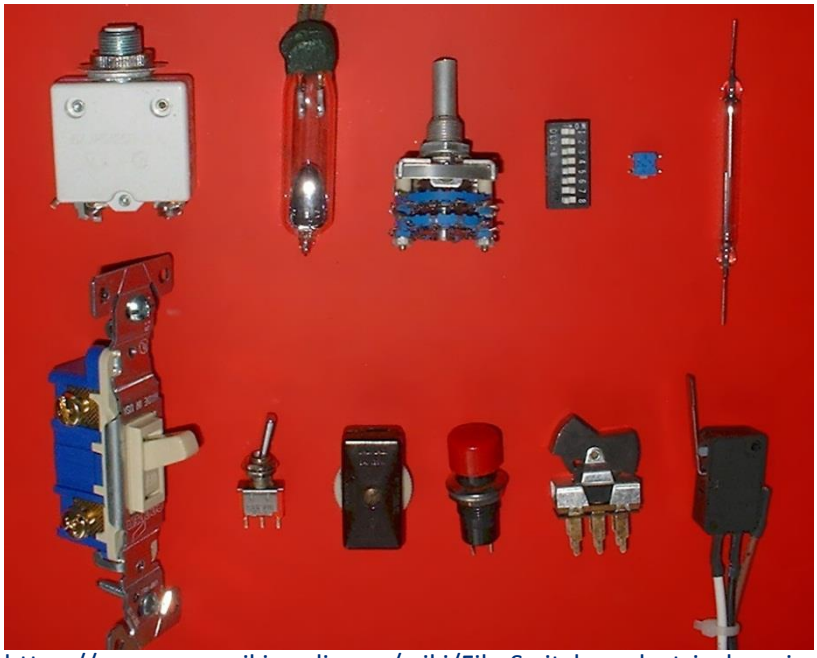
- 4.5 V lantern
- D (R20) torch battery
- C (R14) torch battery
- AA (R6) torch battery
- AA (R03) pencil battery
- AAAA (R61) battery
- A23 (8LR932) battery
- 9-Volt (6LR61) "square" battery
- CR2032 lithium coin battery
- LR44 coin battery
- Matchstick and an inch and cm ruler used for scale
- The grid in the background is 7mm square

https://commons.wikimedia.org/wiki/File:Batteries_comparison_4,5_D_C_AA_AAA_AAAA_A23_9V_CR2032_LR44_matchstick-vertical.jpeg

Typical automotive battery

https://commons.wikimedia.org/wiki/File:Photo-CarBattery.jpg

Examples of Switches and Buttons



Electrical switches

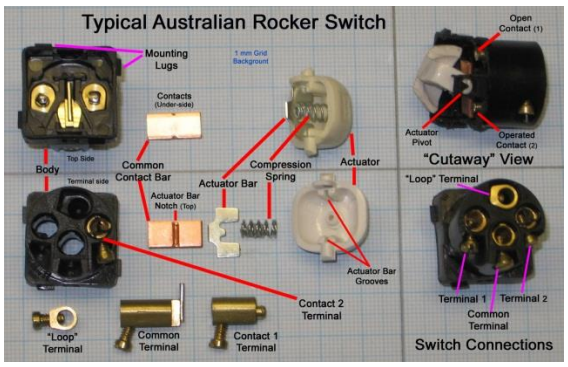
Top, left to right: circuit breaker, mercury switch, wafer switch, DIP switch, surface mount switch, reed switch

Bottom, left to right: wall switch (U.S. style), miniature toggle switch, in-line switch, push-button switch, rocker switch, micro-switch

https://commons.wikimedia.org/wiki/File:Switches-electrical.agr.jpg

Australian Light Switch

https://commons.wikimedia.org/wiki/File:Australian_Light_Switch.jpg#/media/File:Australian_Light_Switch.jpg

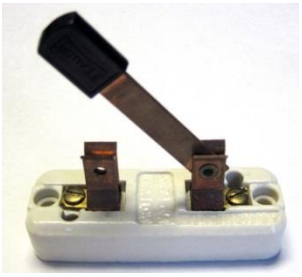


The components of TWO switches are shown, together with a cutaway view and a view of the switch connections

https://commons.wikimedia.org/wiki/File:Typical_Australian_Rocker_Switch.jpg

Rocker switch. ON-OFF, Ø30mm, 125V. 16A (250V. 10A)

https://commons.wikimedia.org/wiki/Category:Rocker_switches#/media/File:3977.jpg



Open knife switch
https://commons.wikimedia.org/wiki/File:Open_knife_switch.jpg#/media/File:Open_knife_switch.jpg

Emergency; Push the button https://www.flickr.com/photos/jar0d/5118361627/

Push to make tactile switch
https://www.flickr.com/photos/snazzyguy/9601239857/

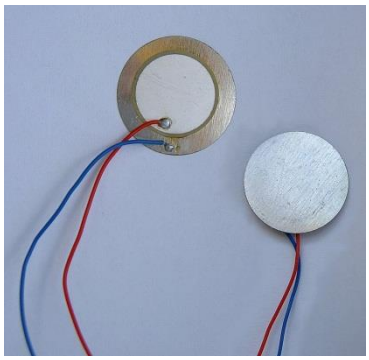
Rotary switch https://commons.wikimedia.org/wiki/File:Heavy_Switch_1.jpg

Push Red Stop, Push Green Go
https://commons.wikimedia.org/wiki/File:Ein-aus-schalter.JPG

Sound-making devices

Typical electromagnetic buzzers

https://commons.wikimedia.org/wiki/File:Electromagnetic_buzzer_02.jpg



Piezoelectric buzzers

https://commons.wikimedia.org/wiki/File:Piezo.jpg

An inexpensive, low-fidelity 90mm speaker, typically found in small radios

https://commons.wikimedia.org/wiki/File:3.5_Inch_Speaker.jpg

Electric bell

https://commons.wikimedia.org/wiki/File:DoorBell_001.jpg

Illumination devices (low voltage)

Low-voltage light bulbs
https://commons.wikimedia.org/wiki/File:Low_voltage_light_bulbs.jpg

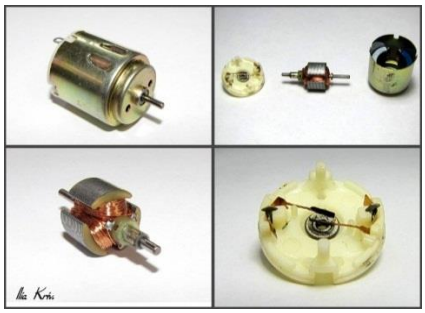
Flashlight or torch
https://commons.wikimedia.org/wiki/File:Flashlight_450x190_commons.jpg

Headlamp
https://www.wpclipart.com/tools/lights/LED_headlamp.png.html

LED headlamp
https://commons.wikimedia.org/wiki/File:LED_headlamp_(1).jpg

LED flashlights
https://commons.wikimedia.org/wiki/File:3_Lampen--_49_LED,_30_LED,_7_LED%2B_Kryptonbirne1.jpg

DC motors



Four slides that show a common brushed DC electric motor and its insides: rotor (armature), brushes (commutator) and a stator (with permanent magnets)

https://commons.wikimedia.org/wiki/File:Brushed_dc_motor_assembly.jpg

Different types of DC motors and internal components

https://commons.wikimedia.org/wiki/File:Permanent_magnet_elektromotorer.jpg

Small DC motor mounted with gears on a toy car

https://commons.wikimedia.org/wiki/File:Mini_4WD.jpg

Animations of rotations of DC motors (three different types; 20, 50 and 80 degree split armatures)

https://commons.wikimedia.org/wiki/File:Ejs_Open_Source_Direct_Current_Electrical_Motor_Model_Java_Applet_(_DC_Motor_)_50_degree_split_ring.gif

Various electric motors, compared to 9 V battery

https://commons.wikimedia.org/wiki/File:Motors01CJC.jpg

ACKNOWLEDGEMENTS

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